学校编码：10384　　分类号_____密级____
学号：19920091152454　　UDC____

硕　士　学　位　论　文

装载机三种无线控制方案的设计研究与对比分析

Research Designs and Comparative Analysis of Three Wireless Controlling Programs for Loader

黄志凌

指导教师姓名　：冯勇建　　教授

专　业　名　称　：测试计量技术及仪器

论文提交日期　：2012　年　　5　　月

论文答辩时间　：2012　年　　月

学位授予日期　：2012　年　　月

答辩委员会主席：_____

评　　阅　　人：_____

2012　年　5　月

厦门大学学位论文原创性声明

本人呈交的学位论文是本人在导师指导下，独立完成的研究成果。本人在论文写作中参考其他个人或集体已经发表的研究成果，均在文中以适当方式明确标明，并符合法律规范和《厦门大学研究生学术活动规范（试行）》。

另外，该学位论文为（　　）课题（组）的研究成果，获得（　　）课题（组）经费或实验室的资助，在（　　）实验室完成。（请在以上括号内填写课题或课题组负责人或实验室名称，未有此项声明内容的，可以不作特别声明。）

声明人（签名）：

年　　月　　日

厦门大学学位论文著作权使用声明

本人同意厦门大学根据《中华人民共和国学位条例暂行实施办法》等规定保留和使用此学位论文，并向主管部门或其指定机构送交学位论文（包括纸质版和电子版），允许学位论文进入厦门大学图书馆及其数据库被查阅、借阅。本人同意厦门大学将学位论文加入全国博士、硕士学位论文共建单位数据库进行检索，将学位论文的标题和摘要汇编出版，采用影印、缩印或者其它方式合理复制学位论文。

本学位论文属于：

（　　）1.经厦门大学保密委员会审查核定的保密学位论文，于　　年　　月　　日解密，解密后适用上述授权。

（　　）2.不保密，适用上述授权。

（请在以上相应括号内打“√”或填上相应内容。保密学位论文应是已经厦门大学保密委员会审定过的学位论文，未经厦门大学保密委员会审定的学位论文均为公开学位论文。此声明栏不填写的，默认为公开学位论文，均适用上述授权。）

声明人（签名）：

年　　月　　日

摘 要

本研究以厦门大学与厦门厦工机械股份有限公司联合开发项目“滑移装载机远程无线监视与控制系统”为背景，着力研究解决装载机无线工作中的控制与操作，并实时监测车况信息，实现远程无线工程作业。为了满足不同行业对远程无人装载机操作工况的需求，基于组网方式的多样性，设计开发了三种不同的无线组网控制方案。就此，本文主要研究工作如下：

1．采用点对点无线通讯的 CDMA 组网方式，针对远程客户端 PLC 操作平台数据及车载终端 PLC 车况数据，基于 CAN2.0B 协议标准帧格式进行双向传输，实现了远程客户端及车载终端之间无线数据通信；采用模块化的设计方法，开发了以单片机 PIC16F877A 为主芯片的 CAN 转 232 模块，实现了远程监控上位机与远程客户端 PLC 之间数据传输协议的自动转换，引入 Visual C++对远程监控上位机进行界面设计，实现了装载机车载信息远程监视，完成了具有远程模拟驾驶室操作功能的无线控制方案的设计。

2．采用点对点无线通讯的 3G 组网方式，基于 3G 模块封装的报文格式，以 Visual C#原创性设计了远程客户端 3G 控制界面，实现了通过网络与车载终端 3G 模块进行双向数据传输，解决了远程客户端上位机 3G 软件与车载终端 PLC 数据通信的问题，完成了具有操作及监视功能的远程客户端上位机软件的无线控制方案的设计。

3．采用无线路由搭建小范围无线覆盖为组网方式，基于 PLC 标准的 CAN 数据协议，利用上位机作为服务器端工作模式的方法，引入自主原创的拖拽式控件及多点触摸方式，以 Visual C#原创性设计了远程客户端网络控制界面，实现了利用网络与车载 PLC 控制器 CAN 总线进行数据通信，完成了具有无线远程操作功能的远程客户端上位机软件的无线控制方案的设计。

4．通过装载机多种工况的综合测试和实验，测得的数据分析表明，CDMA 及 3G 组网方式远程传输存在一定的延时，其它无线通讯性能良好，所开发的无线控制方案具有较好的稳定性及可靠性，能准确的实现远程无线工程作业。

关键词：滑移装载机；无线控制；组网方式；

Abstract

This research takes the joint development project of Xiamen University and Xiamen Engineering Machinery Co., Ltd. Which is called "the remote wireless monitoring and controlling system for slip loader ", as the background. Controlling and operating the loader during wireless work was researched and solved, and the vehicle status information was real-time monitored, remote wireless engineering job was finally accomplished. In order to meet the needs of different industries for operating conditions of long-range unmanned loader, based on the diversity of networkings, three different remote wireless networking control programs were designed and developed. In this article, the main research works are as follows:

1. The networking formation of point-to-point wireless CDMA communication was applied. Aim at platform data of PLC in the remote client and condition data of PLC in the vehicle terminal, according to the format of standard frame based on CAN2.0B protocol, full-duplex communication was realized. Data communication between the remote client and the vehicle terminal was achieved. In order to relize automatic conversion of data transfer protocol between the upper machine which for remote monitoring and the PLC which in the remote client, CAN to 232 modules was developed by using PIC16F877A as the main chip. Upper machine was designed by the introduction of Visual C++ to achieve the loader vehicle information. Finally, the wireless controlling program with the remote operating function of analog cab was finished.

2. The networking formation of point-to-point wireless 3G communication was applied. In order to realize the full-duplex communication between the interface which in the remote client and the 3G module which in the vehicle terminal, and solve the problem of the data communication between the 3G software which in remote client and PLC which in the vehicle terminal, based on the packet format of the 3G module, 3G control interface in the remote client was originally designed by

use of Visual C#. Finally, the wireless controlling program with the PC software provided with operating and monitoring function in remote client was finished.

3. The networking formation of short-range wireless coverage set up by wireless router was applied. In order to realize the full-duplex data communication between the interface which in the remote client and the CAN bus of PLC controller which in the vehicle terminal, based on the standard CAN data protocol of PLC, the method of PC software as a server-side mode was used, originally designed drag-style control and multi-touch were introduced, networking control interface in the remote client was originally designed by use of Visual C#. Finally, the wireless controlling program with the PC software provided with operating function in remote client was finished.

4. Tests and experiments on the multiple conditions of loader were conducted, the measured data was analysed and showed that: there is a certain delay during the remote transmission of CDMA and 3G networking, good performance of other wireless communication, developed wireless controlling programs has good stability and reliability, remote wireless engineering job could be accurate implemented by using the wireless controling programs.

Key Words: skid loader; wireless control; networking;

目 录

Table of Contents